



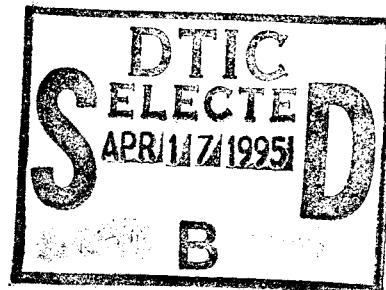
A COMPARISON OF COATING ALTERNATIVES FOR U.S. COAST GUARD AIRCRAFT

By

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INTRODUCTION

The first line of defense against environmental degradation is the organic coating system. Protective organic coating systems are thought to be the rate controlling step in the corrosion of aircraft alloys (Ref 1). Therefore, high performance coatings are essential to the overall operational readiness of Coast Guard aircraft. Current coatings used on Coast Guard (CG) aircraft contain high volatile organic compound (VOC) contents and contribute to the amount of hazardous emissions generated by the Coast Guard. These emissions can be substantial, as evidenced by the Department of Defense naming painting processes used in depot and maintenance operations as a major source of hazardous waste generation (Ref 2). In response to this situation, Federal, State and Local environmental agencies have issued legislation such as the Clean Air Act Amendment (CAAA) Aerospace Control Techniques Guideline (CTG) and local Air Quality Management District Rules to restrict the amount of VOCs emitted from these materials. In particular, the CAAA Aerospace CTG will limit the VOCs of aircraft primers to 340 g/l and aircraft topcoats to 420 g/l. Therefore, new low VOC coatings will be needed for future painting operations to comply with these regulations.

The Naval Air Warfare Center Aircraft Division at Warminster (NAWCADWAR) has a number of on-going efforts dealing with the elimination or reduction of hazardous materials used in aerospace processes as described in Reference 3. A major part of NAWCADWAR's Environmental Materials Program is aimed at solving near and long term environmental problems at all levels of fleet painting operations (depot, intermediate and organizational). Based on this experience, the Naval Air Warfare Center Aircraft Division Warminster was requested by the Coast Guard to investigate several low VOC candidate replacements to their current paint scheme. After several discussions between CG headquarters and NAWCADWAR, the initial list of candidate materials was revised to include the coatings contained in Table I. The physical performance properties of these materials (i.e. corrosion resistance, adhesion, flexibility, etc.) were characterized using standard coatings tests. The following is a description of the materials and tests performed for this evaluation.

EXPERIMENTAL

With the exception of the flexibility tests, the performance properties of the coating systems were evaluated using 2024-T3 aluminum alloys with a standard chromate conversion coating pretreatment. The flexibility test panels are 2024-O Temper annealed with a chromic acid anodized pretreatment. Table I lists the coatings tested for this investigation. Sets of test specimens were prepared at NAWCADWAR and allowed to air dry at $72^{\circ} \pm 5^{\circ}\text{F}$ and 50% R.H. for fourteen days prior to testing. The dry film thicknesses for the primers were 0.6 - 0.9 mils, and the dry film thickness for the topcoats was $2 \pm .2$ mils. These

TABLE I. COATING SYSTEMS EVALUATED

NAWCADWAR System Code	Manufacturer Product Information	Military Specification	VOC Content
CG-1	U.S. Paint High Solids S9800 (Primer)	MIL-P-23377F	340 g/l
	U.S. Paint High Solids K8062 (Topcoat)	--	420 g/l
CG-2	Deft Low Density 44-GN-36 (Primer)	MIL-P-85582	340 g/l
	Deft High Solids 03-W-127A (Topcoat)	MIL-C-85285	420 g/l
CG-3	Deft 02-Y-37 Epoxy (Primer)	MIL-P-23377F	600 g/l
	Deft High Solids 03-W-127A (Topcoat)	MIL-C-85285	420 g/l
CG-4	Deft Low Density 44-GN-36 (Primer)	MIL-P-85582	340 g/l
	Deft Polyurethane (Topcoat)	MIL-C-83286	535 g/l
CG-5	DuPont 825-051 Water Reducible Epoxy (Primer)	--	340 g/l
	DuPont Imron 5000 Polyurethane Enamel (Topcoat)	--	408 g/l
CG-6	Deft Low Density 44-GN-36 (Primer)	MIL-P-85582	340 g/l
	DuPont Imron 5000 Polyurethane Enamel (Topcoat)	--	408 g/l
CG-7	Deft 02-Y-37 Epoxy (Primer)	MIL-P-23377F	600 g/l
	DuPont Imron 5000 Polyurethane Enamel (Topcoat)	--	408 g/l

materials were applied using conventional air spray equipment. The physical performance properties of these materials (i.e. corrosion resistance, adhesion, flexibility, etc.) were characterized using standard coatings tests. Table II contains a

TABLE II. COATING TESTS PERFORMED

Property Evaluated	Test Method	Military Specification	Spec Para.
ADHESION			
Dry & Wet Scrape	ASTM #D 2197	TT-P-2756	--
Dry & Wet Tape Test	ASTM #D3359	MIL-C-85285	--
CORROSION RESISTANCE			
Neutral Salt Spray	ASTM #B 117	TT-P-2756	--
SO ₂ /Salt Spray	ASTM #G 85	TT-P-2756	--
Filiform	--	TT-P-2756	4.6.13.2
RESISTANCE PROPERTIES			
Water (24 hr/RT)	--	TT-P-2756	3.7.6
Water (4 days/120°F)	ASTM #D3359	--	--
Water (7 days/150°F)	--	TT-P-2756	3.7.6
Humidity	ASTM #D 2247	MIL-C-85285	--
Oil/Hydraulic Fluid	--	MIL-C-85285	4.6.8
Skydrol/Hydrocarbon	--	MIL-C-83286	3.7.3.5.b
Solvent (MEK)	--	MIL-C-85285	4.6.11
Heat	--	MIL-C-85285	4.6.10
FLEXIBILITY			
GE Impact	--	MIL-C-85285	4.6.7.1
Mandrel Bend	ASTM #D 1737	MIL-C-85285	--
MISCELLANEOUS			
60° Gloss	ASTM #D 523	MIL-C-85285	--
Weathering	ASTM #G 26	MIL-C-85285	--
Cleanability	--	MIL-C-85285	4.6.13
Strippability	--	TT-P-2756	4.6.12

list of the performance tests for this investigation along with a test method or Military Specification reference.

All of the tests were performed in accordance with the specified method with the exception of the adhesion tape tests. The wet tape test was a modified version of ASTM D 3359, method A. The test was performed by immersing specimens in deionized, distilled water under three conditions (24 hours at 23°C, 96 hours at 49°C, and 168 hours at 65°C). Upon removal, two parallel scribes, 3/4 inch apart, were cut through the coating and into the substrate. An "X" was subsequently scribed through the coating between the two initial scribes. The rest of the test followed the ASTM method. Table III gives the performance description for these adhesion ratings.

TABLE III. ASTM D3359 ADHESION RATINGS

Rating	Description
5	No peeling or removal
4	Trace peeling or removal along incisions
3	Jagged removal along incisions up to 1/16 in. (1.6 mm) on either side
2	Jagged removal along most of incisions up to 1/8 in. (3.2 mm) on either side
1	Removal from most of the area of the X under the tape
0	Removal beyond the area of the X

RESULTS AND DISCUSSION

The tests for this investigation were performed in accordance with current military aircraft topcoat specifications. In addition, some expanded tests were evaluated to gain a better comparison between these systems. The results for these coatings are presented in Appendix A.

Adhesion and Water Resistance

The adhesion tests were performed immediately after the 14 day cure time for the coatings. With further aging of the finishing system, adhesion normally improves, so these results are considered the minimum values. Systems CG-1, CG-3 and CG-7 all had satisfactory to excellent results for the tape tests (4 or 5 rating) and water resistance tests (no effect). These results indicate virtually no susceptibility to coating-substrate

disbondment upon exposure to water. Most aerospace coatings use this adhesion requirement.

System CG-5 had satisfactory performance in the adhesion tape tests, however, it failed in the water resistance tests. The remaining systems had failures in both the adhesion and water resistance tests as indicated on the test sheets in Appendix A. It should be noted that the four systems showing failures in the adhesion and water resistance tests had water reducible primers, whereas, the three unaffected systems had solvent based primers. While this trend was evidenced in these tests, not all water reducible primers show this effect.

A standard aerospace requirement for scrape adhesion is 3 kg. The overall scrape adhesion results for all systems tested ranged from 3 to 10 kg with the exception of systems CG-5 and CG-6 in the wet scrape test. These two coatings had ratings of 2 kg which is considered a borderline failure.

Resistance Tests

The chemical, heat and humidity resistance properties of the systems were evaluated. With the exception of CG-5 and CG-6, all systems had satisfactory to excellent performance in these tests. While passing most of the resistance tests, CG-5 and CG-6 once again showed a susceptibility to water degradation by failing the humidity tests. In addition, CG-5 failed the lubricating oil test.

Flexibility

The flexibility of the systems was measured by the GE Impact and Mandrel Bend tests. For aerospace coatings, a GE Impact rating of 40% or 60% is normally required. All systems had excellent impact resistance (40% to 60%). For aircraft topcoats, a 1 inch mandrel bend at -60°F is normally required. However, there is usually no requirement for a primer since they tend to be brittle. Since these coatings were tested as a system, instead of just the topcoat, the results may be skewed. CG-4 passed a 1 inch mandrel and CG-3 passed a 2 inch mandrel. All other systems were greater than 2 inches.

Corrosion Resistance

Corrosion resistance is an important property for Coast Guard aircraft coatings due to the severe operational environment in which these aircraft are deployed. Most military aircraft primer specifications have a minimum of 1000 hours exposure to salt spray as the corrosion resistance requirement. To evaluate this property, painted specimens were exposed to 5% neutral salt spray, acidified salt spray and filiform corrosion tests and examined for corrosion in the scribe area and blistering or other coating defects. Subsequently, the coatings were carefully removed from the surface with a chemical stripper, without

disturbing the underlying substrate. Upon further examination, there was no additional evidence of underlying corrosion beyond that which was previously detected. The overall rankings of the systems in these tests is provided in Table IV.

TABLE IV. CORROSION RANKINGS FOR COATING SYSTEMS

System	Neutral Salt Spray	SO ₂ /Salt Spray	Filiform
CG-1	1*	4	1*
CG-2	2 [#]	5	4
CG-3	1	1	1
CG-4	2	7	5
CG-5	2	2	7
CG-6	2	6	6
CG-7	1	3	1

* Test results for systems CG-1, 3, & 7 are all equivalent

Neutral Salt Spray test results for systems CG-2, 4, 5, & 6 are all equivalent.

All systems passed 2000 hours salt spray exposure. However, there was a difference between two groups of specimens. Test results indicate that systems CG-1, 3, & 7 provided equivalent corrosion protection. While systems CG-2, 4, 5, & 6 provided acceptable corrosion resistance, they were slightly less than the results for the other systems.

The SO₂/salt spray simulates a marine environment with industrial exhaust gases, such as those found on aircraft carriers from engine exhausts, and is considered to be extremely aggressive. Systems CG-1, 3, 5, & 7 exhibited acceptable protection against this environment. However, systems CG-2, 4, & 6 failed to meet the 500 hour exposure time used for this test.

The filiform test simulates an acidic humid environment which is experienced by most aircraft at some time in their normal operations. Systems CG-1, 3, & 7 exhibited acceptable protection against this environment. However, systems CG-2, 4, 5, & 6 failed to meet the 1000 hour exposure time used for this test.

Other Tests

All systems provided a 60° gloss of greater than 90, the normal requirement. In addition, they all passed the accelerated weathering test and maintained their gloss. Furthermore, the cleanability of these systems was excellent when evaluated under

MIL-C-85285 standards. Finally, systems CG-1, 2, 3, 6, & 7 all met the strippability criterion, with complete removal in less than 15 minutes when exposed to MIL-R-81294. Systems CG-4 & 5 had 100% removal of the topcoat, however, only part of the primer was removed.

Total Performance Evaluation (TPE)

The TPE System is a methodology to quantitatively determine the cumulative effects of a number of coating system properties on overall performance in a specific application. A Zero-Max Technique, which converts property values to an equivalent scale, is used for comparative purposes. In addition, a weighting factor indicating the importance of a specific property relative to the overall performance is determined and utilized to adjust the overall system rating. The TPE ratings of various coatings can be compared to statistically select the optimum material for an intended application. This method was used to compare the coatings in this investigation. Table V lists the systems with their TPE ratings and overall rankings.

TABLE V. TPE RATINGS/RANKINGS FOR THE COATING SYSTEMS EVALUATED

System	Manufacturer Product Information Primer/Topcoat	TPE Rating	Ranking
CG-1	US Paint S9800/K8062	98.2	1
CG-2	Deft 44-GN-36/03-W-127A	83.8	4
CG-3	Deft 02-Y-37/03-W-127A	92.4	2
CG-4	Deft 44-GN-36/Polyurethane Topcoat	79.9	5
CG-5	DuPont 825-051/Imron 5000 Enamel	75.7	6
CG-6	Deft 44-GN-36/DuPont Imron 5000	66.3	7
CG-7	Deft 02-Y-37/DuPont Imron 5000	90.6	3

SUMMARY

The goal of this effort was to evaluate a number of coating systems for use on Coast Guard Aircraft. The tests for this investigation were performed in accordance with current aircraft topcoat specifications. In addition, some expanded tests were performed to gain a better comparison between these systems. The results from this evaluation show that systems CG-1, CG-3 and CG-7 have acceptable performance properties as compared to current systems. Of these three candidates, only the CG-1 system is compliant with the proposed Clean Air Act Amendment (CAAA) Aerospace Control Techniques Guideline. The primer is the system

component which is non-compliant for CG-3 and CG-7. However, since this effort was completed, work was performed to develop low VOC (high solids) versions of this material and they are currently available.

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APPENDIX A

Evaluation of Coast Guard primer & topcoat systems

Name and file number of coating: CG-1
Date: 12 Oct 94
Description:

Weight Factor:	Test Name:	Substrate:	Range:	Lab Data:	Notes:
8.2	Dry Scrape	a	0.5 - 10 + kg	10.0	Excellent
8.2	Wet Scrape (7d/ 150°F)	a	0.5 - 10 + kg	7.0	Excellent
4.6	Dry Tape "A" method	a	0 - 5 (A)	5.0	Excellent
10.0	Wet Tape (24 hr/ RT)	a	0 - 5 (A)	5.0	Excellent
10.0	Wet Tape (4d/ 120°F)	a	0 - 5 (A)	5.0	Excellent
10.0	Wet Tape (7d/ 150°F)	a	0 - 5 (A)	5.0	Excellent
Fluid/ Corrosion Resistance: (100 = P), (66 = +), (33 = -), (0 = F)					
10.0	Salt Spray (2000 hr)	a	0 - 100	100.0	Excellent
10.0	Salt Spray (D 1654) Scribe	a	% Area 100.0	10.0	Excellent
10.0	Salt Spray (D 1654) Gen Surf	a	0 - 10	10.0	Excellent
8.8	SO2 Spray (500 hr)	a	0 - 100	75.0	Satisfactory
8.8	SO2 Spray (D 1654) Scribe	a	% Area 100.0	8.9	Satisfactory
8.8	SO2 Spray (D 1654) Gen Surf	a	0 - 10	10.0	Excellent
9.0	H2O resistance (24 hr/ RT)	a	0 - 100	100.0	Excellent
9.0	H2O resistance (4 d/ 120°F)	a	0 - 100	100.0	Excellent
9.0	H2O resistance (7 d/ 150°F)	a	0 - 100	100.0	Excellent
7.0	Humidity Resistance	a	0 - 100	100.0	Excellent
5.8	23699 Oil (24 hr/ 250°F)	a	0 - 100	100.0	Excellent
5.8	83282 Hydraulic (24 hr/ 150°F)	a	0 - 100	100.0	Excellent
5.8	Skydrol (7 day/RT)	a	0 - 100	100.0	Excellent
6.8	Hydrocarbon JP-5 (7 d/ RT)	a	0 - 100	100.0	Excellent
5.4	Solvent Resistance	a	0 - 100	100.0	Excellent
5.4	Heat Resistance (4 hr/ 250°F)	a	0 - 100	100.0	Excellent
8.2	Filiform Corrosion	a	0 - 100	100.0	Excellent
Flexibility:					
9.0	GE Impact test (gloss)	a	0.5%-60%	60.0	Excellent
0.0	GE Impact test (camouflage)		0.5%-60%		
0.0	Mandrel bend (-60°F)		1" ...2"	>2.0	
Miscellaneous: Put "x" in substrate box below if using wt factors for misc tests					
0.0	60° Gloss (gloss)		unitless	93.5	
0.0	Weather Resistance (500 hr)		unitless	P	
0.0	Gloss after weathering		unitless	92.5	
0.0	Cleanability (%)		unitless	99.1	
0.0	Strippability (% Removed)		unitless	100.0	

NOTES:

Overall Rating: 98.2

Evaluation of Coast Guard primer & topcoat systems

Name and file number of coating: CG-2
 Date: 12 Oct 94
 Description:

Weight Factor:	Test Name:	Substrate:	Range:	Lab Data:	Notes:
8.2	Dry Scrape	a	0.5 - 10+ kg	5.0	Excellent
8.2	Wet Scrape (7d/ 150°F)	a	0.5 - 10+ kg	3.5	Satisfactory
4.6	Dry Tape "A" method	a	0 - 5 (A)	5.0	Excellent
10.0	Wet Tape (24 hr/ RT)	a	0 - 5 (A)	5.0	Excellent
10.0	Wet Tape (4d/ 120°F)	a	0 - 5 (A)	4.0	Satisfactory
10.0	Wet Tape (7d/ 150°F)	a	0 - 5 (A)	1.0	Failure

Fluid/ Corrosion Resistance:			(100 = P), (66 = +), (33 = -), (0 = F)		
10.0	Salt Spray (2000 hr)	a	0 - 100	85.0	Satisfactory
10.0	Salt Spray (D 1654) Scribe	a	% Area 100.0	10.0	Excellent
10.0	Salt Spray (D 1654) Gen Surf	a	0 - 10	10.0	Excellent
8.8	SO2 Spray (500 hr)	a	0 - 100	65.0	Borderline Failure
8.8	SO2 Spray (D 1654) Scribe	a	% Area 100.0	7.9	Borderline Failure
8.8	SO2 Spray (D 1654) Gen Surf	a	0 - 10	10.0	Excellent
9.0	H2O resistance (24 hr/ RT)	a	0 - 100	100.0	Excellent
9.0	H2O resistance (4 d/ 120°F)	a	0 - 100	100.0	Excellent
9.0	H2O resistance (7 d/ 150°F)	a	0 - 100	100.0	Excellent
7.0	Humidity Resistance	a	0 - 100	100.0	Excellent
5.8	23699 Oil (24 hr/ 250°F)	a	0 - 100	100.0	Excellent
5.8	83282 Hydraulic (24 hr/ 150°F)	a	0 - 100	100.0	Excellent
5.8	Skydrol (7 day/RT)	a	0 - 100	90.0	Satisfactory
6.8	Hydrocarbon JP-5 (7 d/ RT)	a	0 - 100	100.0	Excellent
5.4	Solvent Resistance	a	0 - 100	100.0	Excellent
5.4	Heat Resistance (4 hr/ 250°F)	a	0 - 100	100.0	Excellent
8.2	Filiform Corrosion	a	0 - 100	65.0	Borderline Failure

Flexibility:					
9.0	GE Impact test (gloss)	a	0.5%-60%	60.0	Excellent
0.0	GE Impact test (camouflage)		0.5%-60%		
0.0	Mandrel bend (-60°F)		1"...2"	> 2.0	

Miscellaneous:		Put "x" in substrate box below if using wt factors for		
0.0	60° Gloss (gloss)		unitless	92.3
0.0	Weather Resistance (500 hr)		unitless	p
0.0	Gloss after weathering		unitless	91.1
0.0	Cleanability (%)		unitless	97.5
0.0	Strippability (% Removed)		unitless	100.0

NOTES:

Overall Rating: 83.8

Evaluation of Coast Guard primer & topcoat systems

Name and file number of coating: CG-3
 Date: 12 Oct 94
 Description:

Weight Factor:	Test Name:	Substrate:	Range:	Lab Data:	Notes:
8.2	Dry Scrape	a	0.5 - 10 + kg	6.0	Excellent
8.2	Wet Scrape (7d/ 150°F)	a	0.5 - 10 + kg	4.0	Satisfactory
4.6	Dry Tape "A" method	a	0 - 5 (A)	5.0	Excellent
10.0	Wet Tape (24 hr/ RT)	a	0 - 5 (A)	4.0	Satisfactory
10.0	Wet Tape (4d/ 120°F)	a	0 - 5 (A)	4.0	Satisfactory
10.0	Wet Tape (7d/ 150°F)	a	0 - 5 (A)	4.0	Satisfactory

Fluid/ Corrosion Resistance:		(100 = P), (66 = +), (33 = -), (0 = F)			Notes:
10.0	Salt Spray (2000 hr)	a	0 - 100	100.0	Excellent
10.0	Salt Spray (D 1654) Scribe	a	% Area	100.0	Excellent
10.0	Salt Spray (D 1654) Gen Surf	a	0 - 10	10.0	Excellent
8.8	SO2 Spray (500 hr)	a	0 - 100	95.0	Excellent
8.8	SO2 Spray (D 1654) Scribe	a	% Area	100.0	Satisfactory
8.8	SO2 Spray (D 1654) Gen Surf	a	0 - 10	10.0	Excellent
9.0	H2O resistance (24 hr/ RT)	a	0 - 100	100.0	Excellent
9.0	H2O resistance (4 d/ 120°F)	a	0 - 100	100.0	Excellent
9.0	H2O resistance (7 d/ 150°F)	a	0 - 100	100.0	Excellent
7.0	Humidity Resistance	a	0 - 100	100.0	Excellent
5.8	23699 Oil (24 hr/ 250°F)	a	0 - 100	100.0	Excellent
5.8	83282 Hydraulic (24 hr/ 150°F)	a	0 - 100	100.0	Excellent
5.8	Skydrol (7 day/RT)	a	0 - 100	90.0	Satisfactory
6.8	Hydrocarbon JP-5 (7 d/ RT)	a	0 - 100	100.0	Excellent
5.4	Solvent Resistance	a	0 - 100	100.0	Excellent
5.4	Heat Resistance (4 hr/ 250°F)	a	0 - 100	100.0	Excellent
8.2	Filiform Corrosion	a	0 - 100	100.0	Excellent

Flexibility:					Excellent
9.0	GE Impact test (gloss)	a	0.5%-60%	60.0	
0.0	GE Impact test (camouflage)		0.5%-60%		
0.0	Mandel bend (-60°F)		1"...2"	2.0	

Miscellaneous:		Put "x" in substrate box below if using wt factors for misc tests		
0.0	60° Gloss (gloss)		unitless	92.2
0.0	Weather Resistance (500 hr)		unitless	p
0.0	Gloss after weathering		unitless	91.4
0.0	Cleanability (%)		unitless	97.0
0.0	Strippability (% Removed)		unitless	100.0

NOTES:

Overall Rating: 92.4

Evaluation of Coast Guard primer & topcoat systems

Name and file number of coating: CG-4
 Date: 12 Oct 94
 Description:

Weight Factor:	Test Name:	Substrate:	Range:	Lab Data:	Notes:
8.2	Dry Scrape	a	0.5 - 10 + kg	6.0	Excellent
8.2	Wet Scrape (7d/ 150°F)	a	0.5 - 10 + kg	3.0	Satisfactory
4.6	Dry Tape "A" method	a	0 - 5 (A)	5.0	Excellent
10.0	Wet Tape (24 hr/ RT)	a	0 - 5 (A)	5.0	Excellent
10.0	Wet Tape (4d/ 120°F)	a	0 - 5 (A)	4.0	Satisfactory
10.0	Wet Tape (7d/ 150°F)	a	0 - 5 (A)	1.0	Failure

Fluid/ Corrosion		(100 = P), (66 = +),			
Resistance:		(33 = -), (0 = F)			
10.0	Salt Spray (2000 hr)	a	0 - 100	85.0	Satisfactory
10.0	Salt Spray (D 1654) Scribe	a	% Area 100.0	10.0	Excellent
10.0	Salt Spray (D 1654) Gen Surf	a	0 - 10	10.0	Excellent
8.8	SO2 Spray (500 hr)	a	0 - 100	55.0	Borderline Failure
8.8	SO2 Spray (D 1654) Scribe	a	% Area 100.0	7.9	Borderline Failure
8.8	SO2 Spray (D 1654) Gen Surf	a	0 - 10	10.0	Excellent
9.0	H2O resistance (24 hr/ RT)	a	0 - 100	100.0	Excellent
9.0	H2O resistance (4 d/ 120°F)	a	0 - 100	100.0	Excellent
9.0	H2O resistance (7 d/ 150°F)	a	0 - 100	32.0	Failure
7.0	Humidity Resistance	a	0 - 100	100.0	Excellent
5.8	23699 Oil (24 hr/ 250°F)	a	0 - 100	100.0	Excellent
5.8	83282 Hydraulic (24 hr/ 150°F)	a	0 - 100	100.0	Excellent
5.8	Skydrol (7 day/RT)	a	0 - 100	100.0	Excellent
6.8	Hydrocarbon JP-5 (7 d/ RT)	a	0 - 100	100.0	Excellent
5.4	Solvent Resistance	a	0 - 100	100.0	Excellent
5.4	Heat Resistance (4 hr/ 250°F)	a	0 - 100	100.0	Excellent
8.2	Filiform Corrosion	a	0 - 100	50.0	Borderline Failure

Flexibility:					
9.0	GE Impact test (gloss)	a	0.5%-60%	60.0	Excellent
0.0	GE Impact test (camouflage)		0.5%-60%		
0.0	Mandrel bend (-60°F)		1"...2"	1.0	

Miscellaneous:		Put "x" in substrate box below if using wt factors for misc tests			
0.0	60° Gloss (gloss)		unitless	93.5	10% pr, 100% tc removed
0.0	Weather Resistance (500 hr)		unitless	p	
0.0	Gloss after weathering		unitless	92.8	
0.0	Cleanability (%)		unitless	98.5	
0.0	Strippability (% Removed)		unitless	10.0	

NOTES:

Overall Rating: 79.9

Evaluation of Coast Guard primer & topcoat systems

Name and file number of coating: CG-5
 Date: 12 Oct 94
 Description:

Weight Factor:	Test Name:	Substrate:	Range:	Lab Data:	Notes:
8.2	Dry Scrape	a	0.5 - 10 + kg	6.0	Excellent
8.2	Wet Scrape (7d/ 150°F)	a	0.5 - 10 + kg	2.0	Borderline Failure
4.6	Dry Tape "A" method	a	0 - 5 (A)	5.0	Excellent
10.0	Wet Tape (24 hr/ RT)	a	0 - 5 (A)	4.0	Satisfactory
10.0	Wet Tape (4d/ 120°F)	a	0 - 5 (A)	4.0	Satisfactory
10.0	Wet Tape (7d/ 150°F)	a	0 - 5 (A)	4.0	Satisfactory

Fluid/ Corrosion Resistance: (100 = P), (66 = +),
 (33 = -), (0 = F)

10.0	Salt Spray (2000 hr)	a	0 - 100	85.0	Satisfactory
10.0	Salt Spray (D 1654) Scribe	a	% Area 100.0	10.0	Excellent
10.0	Salt Spray (D 1654) Gen Surf	a	0 - 10	10.0	Excellent
8.8	SO2 Spray (500 hr)	a	0 - 100	85.0	Satisfactory
8.8	SO2 Spray (D 1654) Scribe	a	% Area 100.0	8.9	Satisfactory
8.8	SO2 Spray (D 1654) Gen Surf	a	0 - 10	10.0	Excellent
9.0	H2O resistance (24 hr/ RT)	a	0 - 100	100.0	Excellent
9.0	H2O resistance (4 d/ 120°F)	a	0 - 100	100.0	Excellent
9.0	H2O resistance (7 d/ 150°F)	a	0 - 100	0.0	Failure
7.0	Humidity Resistance	a	0 - 100	25.0	Failure
5.8	23699 Oil (24 hr/ 250°F)	a	0 - 100	0.0	Failure
5.8	83282 Hydraulic (24 hr/ 150°F)	a	0 - 100	100.0	Excellent
5.8	Skydrol (7 day/RT)	a	0 - 100	100.0	Excellent
6.8	Hydrocarbon JP-5 (7 d/ RT)	a	0 - 100	100.0	Excellent
5.4	Solvent Resistance	a	0 - 100	100.0	Excellent
5.4	Heat Resistance (4 hr/ 250°F)	a	0 - 100	100.0	Excellent
8.2	Filiform Corrosion	a	0 - 100	25.0	Failure

Flexibility:

9.0	GE Impact test (gloss)	a	0.5%-60%	40.0	Excellent
0.0	GE Impact test (camouflage)		0.5%-60%		
0.0	Mandrel bend (-60°F)		1"...2"	> 2.0	

Miscellaneous:

Put "x" in substrate box below if using wt factors for misc tests

0.0	60° Gloss (gloss)		unitless	94.1	
0.0	Weather Resistance (500 hr)		unitless	p	
0.0	Gloss after weathering		unitless	93.5	
0.0	Cleanability (%)		unitless	98.9	
0.0	Strippability (% Removed)		unitless	50.0	50% pr, 100% tc removed

NOTES:

Overall Rating: 75.7

Evaluation of Coast Guard primer & topcoat systems

Name and file number of coating: CG-6
 Date: 12 Oct 94
 Description:

Weight Factor:	Test Name:	Substrate:	Range:	Lab Data:	Notes:
8.2	Dry Scrape	a	0.5 - 10+ kg	6.0	Excellent
8.2	Wet Scrape (7d/ 150°F)	a	0.5 - 10+ kg	2.0	Borderline Failure
4.6	Dry Tape "A" method	a	0 - 5 (A)	5.0	Excellent
10.0	Wet Tape (24 hr/ RT)	a	0 - 5 (A)	5.0	Excellent
10.0	Wet Tape (4d/ 120°F)	a	0 - 5 (A)	2.0	Failure
10.0	Wet Tape (7d/ 150°F)	a	0 - 5 (A)	0.0	Failure

Fluid/ Corrosion Resistance:		(100 = P), (66 = +), (33 = -), (0 = F)			Notes:
Weight Factor:	Test Name:	Substrate:	Range:	Lab Data:	
10.0	Salt Spray (2000 hr)	a	0 - 100	85.0	Satisfactory
10.0	Salt Spray (D 1654) Scribe	a	% Area	100.0	Excellent
10.0	Salt Spray (D 1654) Gen Surf	a	0 - 10	10.0	Excellent
8.8	SO2 Spray (500 hr)	a	0 - 100	60.0	Borderline Failure
8.8	SO2 Spray (D 1654) Scribe	a	% Area	100.0	Borderline Failure
8.8	SO2 Spray (D 1654) Gen Surf	a	0 - 10	10.0	Excellent
9.0	H2O resistance (24 hr/ RT)	a	0 - 100	100.0	Excellent
9.0	H2O resistance (4 d/ 120°F)	a	0 - 100	30.0	Failure
9.0	H2O resistance (7 d/ 150°F)	a	0 - 100	30.0	Failure
7.0	Humidity Resistance	a	0 - 100	30.0	Failure
5.8	23699 Oil (24 hr/ 250°F)	a	0 - 100	100.0	Excellent
5.8	83282 Hydraulic (24 hr/ 150°F)	a	0 - 100	100.0	Excellent
5.8	Skydrol (7 day/RT)	a	0 - 100	100.0	Excellent
6.8	Hydrocarbon JP-5 (7 d/ RT)	a	0 - 100	100.0	Excellent
5.4	Solvent Resistance	a	0 - 100	100.0	Excellent
5.4	Heat Resistance (4 hr/ 250°F)	a	0 - 100	100.0	Excellent
8.2	Filiform Corrosion	a	0 - 100	32.0	Failure

Flexibility:					Notes:
Weight Factor:	Test Name:	Substrate:	Range:	Lab Data:	
9.0	GE Impact test (gloss)	a	0.5%-60%	40.0	Excellent
0.0	GE Impact test (camouflage)		0.5%-60%		
0.0	Mandrel bend (-60°F)		1"...2"	> 2.0	

Miscellaneous:		Put "x" in substrate box below if using wt factors for misc tests		
Weight Factor:	Test Name:	Substrate:	Range:	Lab Data:
0.0	60° Gloss (gloss)		unitless	94.0
0.0	Weather Resistance (500 hr)		unitless	p
0.0	Gloss after weathering		unitless	93.5
0.0	Cleanability (%)		unitless	99.0
0.0	Strippability (% Removed)		unitless	100.0

NOTES:

Overall Rating: 66.3

Evaluation of Coast Guard primer & topcoat systems

Name and file number of coating: CG-7
 Date: 12 Oct 94
 Description:

Weight Factor:	Test Name:	Substrate:	Range:	Lab Data:	Notes:
8.2	Dry Scrape	a	0.5 - 10+ kg	5.0	Excellent
8.2	Wet Scrape (7d/ 150°F)	a	0.5 - 10+ kg	3.0	Satisfactory
4.6	Dry Tape "A" method	a	0 - 5 (A)	4.0	Satisfactory
10.0	Wet Tape (24 hr/ RT)	a	0 - 5 (A)	4.0	Satisfactory
10.0	Wet Tape (4d/ 120°F)	a	0 - 5 (A)	4.0	Satisfactory
10.0	Wet Tape (7d/ 150°F)	a	0 - 5 (A)	4.0	Satisfactory

Fluid/ Corrosion Resistance: (100 = P), (66 = +), (33 = -), (0 = F)

10.0	Salt Spray (2000 hr)	a	0 - 100	100.0	Excellent
10.0	Salt Spray (D 1654) Scribe	a	% Area 100.0	10.0	Excellent
10.0	Salt Spray (D 1654) Gen Surf	a	0 - 10	10.0	Excellent
8.8	SO2 Spray (500 hr)	a	0 - 100	80.0	Satisfactory
8.8	SO2 Spray (D 1654) Scribe	a	% Area 100.0	8.9	Satisfactory
8.8	SO2 Spray (D 1654) Gen Surf	a	0 - 10	10.0	Excellent
9.0	H2O resistance (24 hr/ RT)	a	0 - 100	100.0	Excellent
9.0	H2O resistance (4 d/ 120°F)	a	0 - 100	100.0	Excellent
9.0	H2O resistance (7 d/ 150°F)	a	0 - 100	100.0	Excellent
7.0	Humidity Resistance	a	0 - 100	100.0	Excellent
5.8	23699 Oil (24 hr/ 250°F)	a	0 - 100	100.0	Excellent
5.8	83282 Hydraulic (24 hr/ 150°F)	a	0 - 100	100.0	Excellent
5.8	Skydrol (7 day/RT)	a	0 - 100	100.0	Excellent
6.8	Hydrocarbon JP-5 (7 d/ RT)	a	0 - 100	100.0	Excellent
5.4	Solvent Resistance	a	0 - 100	100.0	Excellent
5.4	Heat Resistance (4 hr/ 250°F)	a	0 - 100	100.0	Excellent
8.2	Filiform Corrosion	a	0 - 100	100.0	Excellent

Flexibility:

9.0	GE Impact test (gloss)	a	0.5%-60%	40.0	Excellent
0.0	GE Impact test (camouflage)		0.5%-60%		
0.0	Mandrel bend (-60°F)		1"...2"	>2.0	

Miscellaneous:

Put "x" in substrate box below if using wt factors for misc tests

0.0	60° Gloss (gloss)		unitless	93.6
0.0	Weather Resistance (500 hr)		unitless	p
0.0	Gloss after weathering		unitless	93.8
0.0	Cleanability (%)		unitless	99.0
0.0	Strippability (% Removed)		unitless	100.0

NOTES:

Overall Rating: 90.6

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